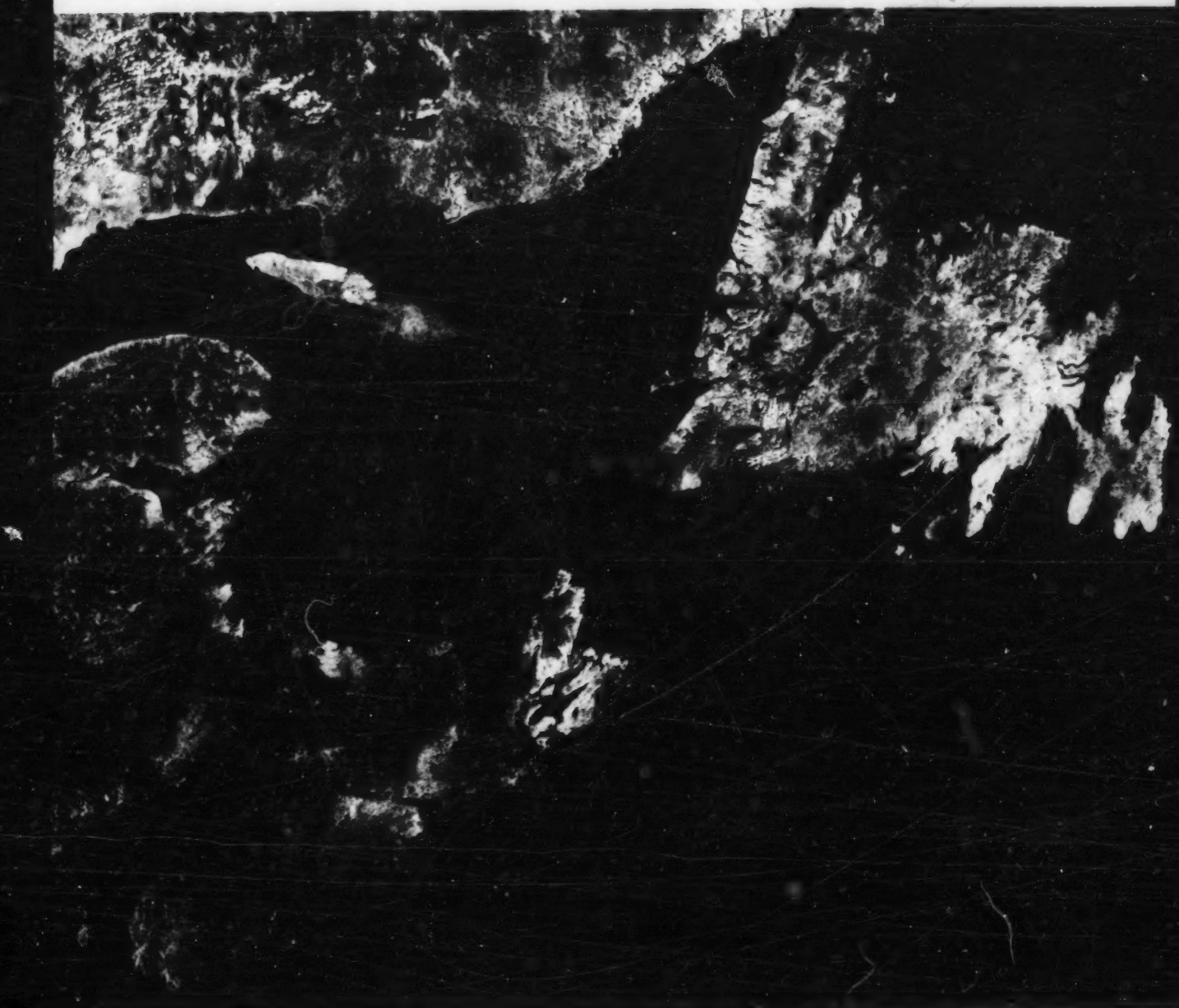
THE COASTAL ZONE
A CHALLENGE IN RESOURCES MANAGEMENT

STANLEY E. VASS



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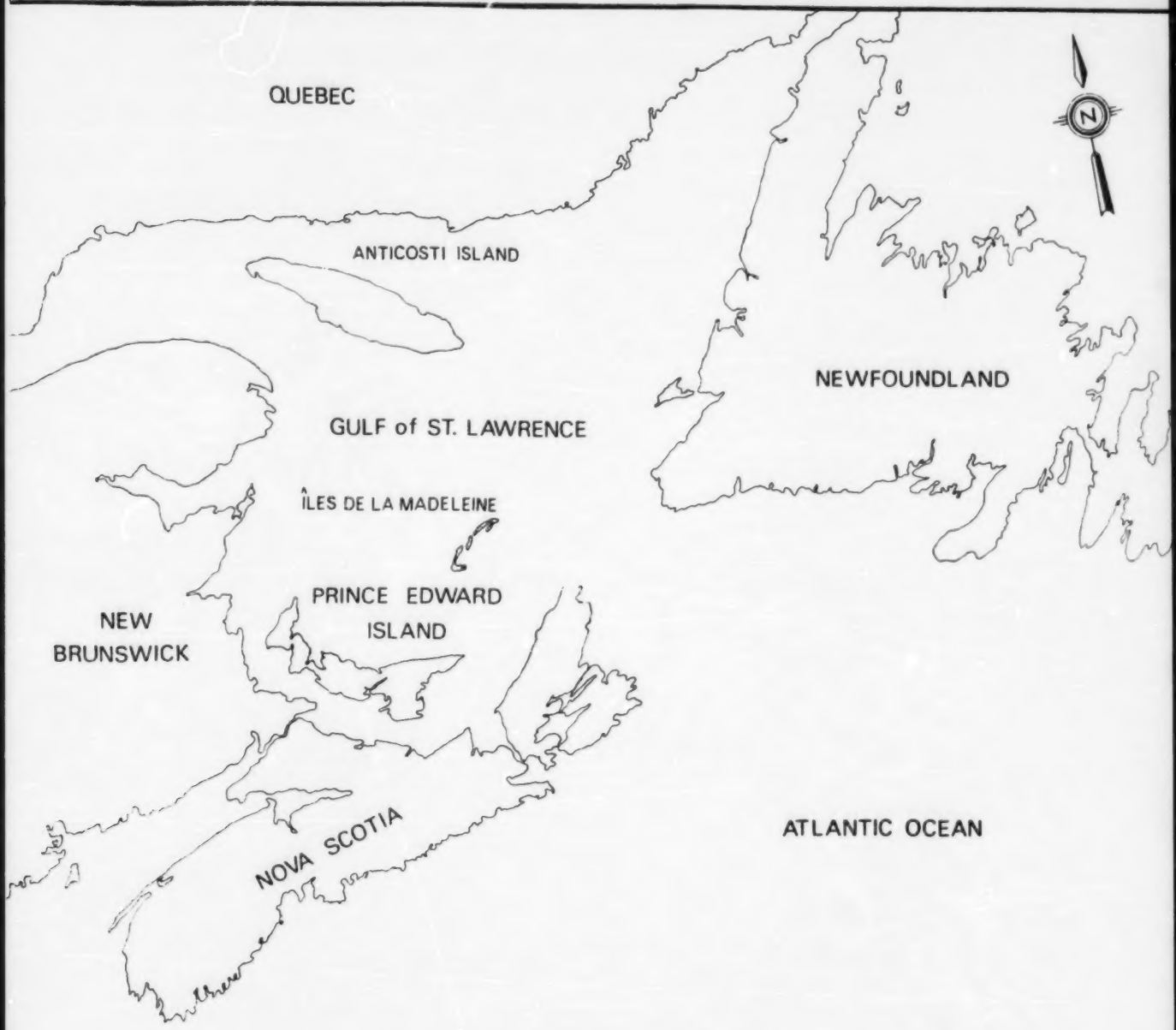

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The Coastal Zone;
A Challenge in Resources Management

by

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FOREWORD

This thematic paper is one of five produced in support of Canada's participation in the United Nations Water Conference held at Mar del Plata, Argentina, March 14-25, 1977. The papers were submitted for review by a federal-provincial preparatory committee that assisted Inland Waters Directorate, Environment Canada, in preparing the technical content of Canada's position at the conference, and were further circulated among appropriate departments of federal and provincial governments for comment.

The subject of this paper is in ways peripheral to the main concern of the conference -- the adequacy and quality of global fresh water -- yet management of inland waters without consideration for its influence upon coastal receiving waters would be irresponsible, from an ecological viewpoint. Accordingly, our subject was chosen partly for that interaction and partly because of its obvious importance to coastal nations, the Atlantic Provinces and Prince Edward Island, in particular.

Following the conference the PEI Department of Environment decided that this paper should be more widely distributed, at least in Atlantic Canada, for the purposes of increasing awareness of the United Nations' work on global environmental problems and promoting interest in a regional approach to management of the Atlantic Provinces' coastal zone.

In preparation for this printing the author made a number of editorial corrections and improvements to the text, taking care to preserve its original substance. And lastly, it should be noted that the opinions expressed in this work are those of the author and they are not necessarily shared by the government of Prince Edward Island.

ACKNOWLEDGEMENTS

Thanks are due to Inland Waters Directorate, Environment Canada, for having invited provincial contributions to the documentary support of Canada's position at the United Nations Water Conference; and particularly to Mr. J.P.Bruce and Mr. R.B.L.Stoddard for their guidance and patience in the face of deadlines passed. Many persons generously assisted the writer, including Dr. Lloyd M.Dickie, Dr.William L. Ford, Mr. Peter Jacobs, Mr. Thomas Owen and Dr. Ronald Loucks. Their encouragement and criticism were much appreciated even though, as imperfections in the paper attest, it was not always heeded. To Dr. Patricia Roberts-Pichette go thanks for a perspective on the subject gained through the writer's association with her and the MAB (Canada) Program. The writer was afforded this assignment and all practical assistance by Mr. Arthur J. Hiscock, Deputy Minister, PEI Department of Environment, whose confidence we hope was not misplaced. Mrs. Margaret R.Hughes competently and cheerfully provided typing and other essential secretarial services.

ABSTRACT

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From accumulating evidence of growing instability, declining productivity and conflicting use among world water resources, coastal ecosystems are identified as deserving urgent attention through improved research and management. Topics are treated in general terms and related briefly to major social issues. Two points are stressed: that better interpretation of information and better decision making arrangements in government are prerequisite to improving management; and that the latter must be applied more critically, fundamentally and comprehensively.

Man's inherent limitations in conceptualizing natural systematic processes give him an over simplified view of the environment and, failing to take resources interaction fully into account, his management of natural resources is too often superficial. Institutional arrangements for decision making inadequately provide for interaction among departments of related affairs, thereby further encumbering comprehension and decision.

Some recent trends in Canadian institutional arrangements are noted and their implications described in the context of the Eastern Canadian coastal zone. The regional systematic approach to management of interacting social, economic and natural systems is emphasized as a goal, essentially to protect their underlying natural processes. Recommended as an aid to communication and co-ordination is the establishment of regional coastal zone authorities.

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THE COASTAL ZONE;

A CHALLENGE IN RESOURCES MANAGEMENT

INTRODUCTION

The manifold conditions of water, as an essential resource, constitute a global problem in management that is acute for many nations and potentially so even for those richly endowed with the resource. Evidence is accumulating of growing instability in water systems and of their declining supply, quality and productivity; while socio-economic trends presage growing conflict in water use. These appearances combine to suggest that a new approach to water management is required and, of all conditions of water, that of coastal waters and their derived resources seems the most demanding.

The world's coastal zones comprise highly productive ecosystems of great complexity that are still more exploited than managed. The basis for their management has changed little since its empirical founding in earlier times, the salient change being the application of highly effective harvesting techniques without understanding their ecological consequences. Also, where more comprehensive management is being applied it too often involves a bureaucratic procedure whose effectiveness, as evidenced by present circumstances of the resource, is less than we might reasonably expect.

Water resources are part of the wider spectrum of natural resources whose management is one of the major issues of modern society; and the coastal zone, while one of its more complex components, for purposes of this

discussion represents that broader issue. Management of the coastal zone, however, differs from that of other water resources where, because of priorities and long sustained effort, there have evolved more co-ordinated and effective institutional arrangements for decision making. This is evidenced in Canada by the several comprehensive river basin developments of recent years and the degree of our response to the crisis of eutrophication in the Great Lakes.

In contrast, the coastal zone as an entity is not publically perceived as an object for management, nor is it so for those federal and provincial departments having some competence for dealing with it; and as a consequence it has yet to receive political recognition. Instead research, resource allocation and management are highly fractionated under a dichotomy of interests. On the one hand is the interest of industrial exploitation rationalized in terms of resource needs, the alleviation of regional economic disparity and seeming natural abundance; while on the other are many activities, including aspects of fisheries, that are motivated by concerns for conservation and environmental quality.

This paper examines coastal zone management against a backdrop of society's apprehensions over the economic, environmental and social issues of the times. By comparing the need for management with the institutions and procedures for management decisions we hope to make the first of two mainpoints. It is that *before we can exercise more responsible and effective management of the coastal zone we must first improve our means for handling information and making decisions.*

Our second point devolves from the nature of the coastal zone. The rich and varied resources of coastal

ecosystems are created and sustained through the interaction of complex physical and biological processes. What has so far passed for management there (to oversimplify) has been the manipulation of individual derived resources with scant recognition of their interaction. Even more serious, we either do not understand the limits within which their underlying processes operate, or where something of this is known we have not seriously applied the knowledge as a basis for management.

It therefore seems probable that to persist in manipulating coastal resources blindly is to court substantial and perhaps irreversible change to the system of processes that sustains them. Our second point, then, is to emphasize *the need for a more fundamental, comprehensive approach to resources management and to accelerate research therein.*

BACKGROUND

The serious observer today cannot fail to be impressed by the complexity of modern technology and the institutions and procedures established to serve and govern society. Moreover, concerned people are also aware that those vaunted facilities are evermore failing reasonable expectations for their effectiveness, particularly in terms of human development.

Issues facing modern society are assuming such proportions, complexity and extent of interaction that one wonders whether the human intellect can comprehend their totality while, at the same time and in the name of management, manipulate their dynamics. Borrowing a term from cybernetics we face the task of solving 'metaproblems', a hierarchy of which is our legacy from mankind's long struggle for survival and development,

greatly compounded by the technological advances of the century.

The most common element in this dilemma is complexity, its dominant process interaction, its most evident feature an accelerating rate of change. And although we are coming to recognize this -- our environment -- as a global system of systems and darkly perceive ourselves to be an integral part, we relate to it largely through the medium of information as distinct from direct perception.

From this viewpoint our task can be defined as one of managing ever changing complexity by interpreting information into understanding; and in order to comprehend and respond we must, as emotional rather than rational beings, organize our capabilities, hence the bureaucracies of industry and government. But why do the results not meet our expectations?

Perhaps it is because we have treated matters superficially and outside the context of a system of natural processes. Perhaps our information is at too detailed a level as regards statements of the problems, such that we cannot see the forest for the trees, and as a consequence should be questioning our management objectives for their relevance to the broader issues of society. These assumptions seem verified at least to the extent that authorities in most fields of human endeavour are stressing that *society's problems must be viewed from the widest perspective and approached more fundamentally and critically with emphasis on process over content.*

THE COASTAL ZONE AND ITS RESOURCES

A coastal zone can be variously defined according to the components or parameters of interest. On the one hand it may be that narrow band where air, land and water meet and interact; while on the other it may be a zone of land and water of varying but substantial width in which terrestial and aquatic ecologies are mutually influential to some significant extent.

For other purposes it may be broader still in order to incorporate influences arising distantly inland or at sea. As examples: the sediment burden of littoral drift can be augmented by materials eroded from watershed uplands; hydrocarbons spilled at sea can affect the shoreline; and the hydraulics and water quality of rivers, altered in the hinterland, can influence the quality and productivity of coastal receiving waters.

The importance of the interaction of land and water components of the coastal zone cannot be over emphasized. Their influence ranges from the subtle to the dramatic and while all are significant some, such as the contribution of nutrients by marshlands and rivers or the nursery role of estuaries, are critically important. *The greatest deficiency in coastal resources management is our failure to take these interactions fully into account and the weakness of our institutional arrangements for management decisions is the absence of one designed to comprehend such relationships.*

Historically, coastal zones and especially their estuaries were magnets attracting human settlement, witness the majority of great commercial centres so situated. If one includes the Great Lakes' basin, the fact that nearly

75% of North America's population is contained by that settlement pattern will underscore the point.

The coastal zone of Canada is enormous in extent and impressive in its variety, one of the world's great conglomerations of natural wealth. The generalized configuration of the coastline and its islands -- some 40,000 miles -- though an arresting statistic is a poor criterion of inshore variety and productivity. For that, its roughly estimated sinuosity of 150,000 miles is more evocative. And although it lacks the species diversity of warmer waters this is compensated by remarkable levels of production.

The historical and continuing importance of fisheries in the Atlantic coastal zone needs little elaboration. From inshore aquaculture to deep sea fishing the region has yielded vast quantities of food fish and other marine products in seemingly inexhaustible supply. Its lands provide a basis for that harvesting, much derived industry and a substantial portion of our international maritime commerce. It is potentially a source of fossil fuel, minerals and tidally generated electricity; while opportunities for intensive management of fisheries await only our will and ingenuity for them to be realized.

Northward and around the Arctic slope are lands and waters little explored, their dynamics and ecology poorly understood. Proven reserves of oil, considerable by world standards, and rich mineral deposits hint at the natural wealth to come. Moreover, the Arctic coastal zone is critically important in determining the climate of Canada and the biophysical characteristics of the Atlantic zone.

Westerly the climate elicits more varied but still rich production from the Pacific coastal zone, especially in its terrestial portion. With substantial yields of marine products, remarkable resources ashore and a major role in maritime commerce, this zone rivals its eastern counterpart.

Complementing natural resources are matters of transport and communication, supplies and services, processing and distribution which are either comprised by coastal zone management or interface with it. We are thus led to view the region as a social unit; and the fact that human groups associated with the coastal zone are extensions of the ecosystem itself, modifying and being in turn modified, is one of fundamental importance long underestimated.

Finally, if we are to manage this assemblage of resources effectively we must understand better its operation as a system, for which it is essential to know its underlying natural processes. At this point, however, discussion becomes speculative -- a euphemism for acknowledging uncertainty and ignorance. We have so far been describing a system viewed from the outside and although the resolution of detail is painfully coarse it is enough from which to infer a complicated generative process.

Its basic mechanisms are few and deceptively simple; comprising the physical and chemical properties of water and of terrestial and bottom sediments, the hydrologic cycle and weather, the transformations of living things and the majestic flow of energy. They are deceptively simple in that entire sciences treat only portions of these phenomena yet we stand confused. Deceptive in that for all the pressure of our activities

they display remarkable resiliency and though operating in delicate equilibria possess great stability.

In addition, though alien to Nature's original blueprint, are the forces of emotion, intellect, will and aspiration which move man and whose effects for good or for ill permeate global ecology. These too operate at the heart of the coastal ecosystem because, through conscious intervention or thoughtless application of our technology, we are exerting ever greater stress on the life supporting processes while ignorant or heedless of the consequences. Yet it is through this same technology and guided by greater knowledge of how natural systems operate that we will come to manage resources in harmony with Nature. *Manipulating the factors of production within known limits of environmental process and ecological resiliency must be the goal of resources management.*

PROBLEMS OF COASTAL RESOURCES MANAGEMENT

By extending human senses and facilities with technological aids, man has removed most of the barriers to his reaching and recovering resources. Increased availability not only satisfies current needs but creates opportunities demanding even more resources in a self reinforcing sequence. The material wealth thus obtained improved the health and welfare of much of society but the resulting growth of populations has created what we inelegantly describe as our insatiable appetite for natural resources. It is therefore understandable, if not excusable, that exploitation still shoulders aside intelligent management, that we still apply technology mostly in pursuit of ever diminishing resources.

To elaborate on one example consider the harvesting of fish in the Atlantic coastal zone where, despite our having biological guidelines for harvesting that give some assurance of adequate recruitment, we have recently seen a drastic reduction in the abundance of many species. Our response has been to intensify search for the scarce species and to begin harvesting those previously ignored, with no assurance that these also will not soon decline in number. This pattern of events has become common throughout the world's fisheries.

Clearly something has gone wrong and the solution, as for similar trends in other natural resources, is unlikely to be simple. It might reflect natural cycles unrecognized because the recent past is not a good average condition, but the suspicion is strong that we are exceeding the guidelines for sustainable yield. Perhaps we should be managing not by species alone but comprehensively, from an ecological basis in which the interdependence among all in the system is taken into account. In the least we should not long persist with methods that are patently ineffectual.

Whatever the reason, the concern is that by continuing on the present course we risk reactions that could bring about new configurations in the intricate marine food web. And because of the extent to which living organisms modify their environment, should changing species composition continue then environmental factors may be so altered as to stabilize a new configuration. In that event the task of restoring some preferred mix of plants and animals could be exceedingly difficult.

The fisheries problem (as for those in other re-

sources) can not be solved apart from its derived industry for whom persistent reduction in supply means unemployment and economic distress. By greatly increasing effort at harvesting we can regain economic advantage, though it is increasingly marginal and at the risk of damaging the natural supply of food. *With economic distress being tangible and highly visible it has been our practise to accord it prior attention, while ecological distress has remained for most an unrelated abstraction.*

However, the generality of this condition among world resources is becoming more widely recognized and with it the realization that there are limits to resources supply and the growth of things for which they are employed. Only through a sense of stewardship and commitment to the future can we wisely decide questions raised by the present circumstances of fisheries, but they are ones to ponder as nations move to extend economic dominance over larger areas of their coastal waters. *It is one thing to obtain that jurisdiction and the advantage for exploitation it brings but it is quite another matter to assume and discharge stewardship of the resources.*

At the water's edge management has also been far from commendable. Ribbon development of shorelines, the productive littoral channelized, extensive pollution, coastal wetlands and delicate sand formations obliterated, wildlife habitats destroyed and landscape quality degraded; all attest to man's propensity for discounting future benefits in favour of short term gains. At stake is the equilibrium of land/water interactions and the security of future options.

The management problems we create are frequently

biological, or better ecological, because our works tend to simplify natural variety and lessen the stability this seems to confer upon natural systems. But most of these can be corrected and could be anticipated and mitigated in the future were yet another problem to be resolved. We refer to that of providing adequate and pertinent information to the resource manager and ensuring that his decisions comprehend the interests of related affairs.

PROBLEMS IN DECISION MAKING

Careful consideration of the decision making process as it relates to governments reveals three aspects which limit its efficiency and effectiveness:

1. The vast amounts of data and information that must be culled and treated.
2. The growing need to interpret from information the dynamics of intricate social, economic and natural systems.
3. The limitations to effective communication inherent among the actors concerned, especially our institutions.

Information

Departments of government trade principally in the commodity of information upon which they operate to produce decisions passed to their publics or resulting in management on their behalf. Most are plagued by an overload of information and although this is somewhat relieved by computerization there remains the task of determining its pertinency to a given objective.

When assimilating information we are disposed by

our nature to evaluate it against inherited norms which may be inappropriate or have outlived their usefulness. Also cherished legend, prejudice and assumption die hard and when we do condescend to change an opinion it usually comes to rest at that lowest common denominator of alternatives -- consensus. It is through such limitations that we have arrived at an over simplified model of the world around us.

Imprisoned by this way of thinking and guided by stereotypes of ourselves and our environment we persist in attempting to manage the conditions of yesterday. We react more to the familiars of a management problem than any uniqueness it might possess, thereby repeating our mistakes. Increasingly though, resource problems are characterized by a difference and it is ironic that with an abundance of information -- the catalyst for change -- we can neither handle it properly nor wholly respond to the truths it tells.

Interpretation

In past management we have used information to construct rough impressions of situations in resources and rather simplistic alternatives for action, while in our choice of options we have been persuaded more by social and economic preferences than by environmental concerns. Today we find this an ineffectual, often damaging response to the ailing systems that are our resources and that those environmental concerns have become ecological imperatives.

Yet there are clearly limits to visualizing the intricate workings of systems like the coastal zone and to predicting the consequences of our management. It therefore seems necessary that we make greater use of

computerized simulation modelling to integrate information and, through probability decision theory, produce speculative systems responses as management alternatives. *Only through such aids can we comprehend the complexity and manipulate the dynamics of our environment.*

Communication

Through institutional arrangements we synergize our capabilities directed at improving the common good and supplement the decision making of tradition and the market mechanism. A substantial portion of resource management decisions is taken by those institutions or influenced by them through various suasions upon other managers.

A department of government must operate to reflect prevailing ethics and the existing union of economic theory and political ideology, yet be ever alert to innovation in policy and practise. It must anticipate conflict and bargaining yet protect individual liberties and options for social choice. Importantly, it must allow for reconcilliation of interests, especially through public involvement, yet restrain pressures for unreasonable pluralism in decision making. Above all, it must provide adequate and pertinent information to its political head in support of the overriding political decision.

Such a climate of demands and constraints cause tension on decision making, especially when the quality of information or its interpretation do not facilitate judgement. Moreover, as persuasive arguments suggest, our institutions possess systemic characteristics

which further encumber decision. It is claimed they are functionally self regulating and hence resistant to external influence, yet resilient and adaptable. For these or whatever reasons, a department has the virtue of stability; but at what point does stability become rigidity, or resiliency a resistance to learning? And how sure can we be that 'direction' is not subtly absorbed through shifts in a department's equilibrium?

Of greater concern is how to bridge the separation among departments that is maintained by their sense of territory. True, much of this seeming isolation reflects a necessary preoccupation with an assigned role, but in view of the need for interfacing more effectively various resource, economic and social sectors *so must this apply to their respective institutions.*

It seems to follow logically that we should either construct a true system of institutions (an unlikely event) or improve productive interaction among departments of related affairs. In effect we are speaking of co-operation and co-ordination, words so meaningful as to be almost meaningless.

Lastly, but of foremost importance, is public involvement in government decision making. For many this is the issue of the day and no brief comment can do it justice. To what extent public participation is an unfilled necessity or demands for it an indirect measure of government shortcomings, is a question deserving prompt and serious attention; but its resolution is prerequisite to improved coastal zone and general resources management.

Recapitulating our comments thus far, we have indicated the complex nature of the coastal zone -- its intricate generative process, the interdependence of its production and its close relationship with economic and social systems. We rejected our rather unilateral and superficial treatment of its resources in favour of the more comprehensive and basic. We acknowledge information as the substance of our affairs, noting our limitations in conceptualizing from it the dynamics of natural systems. And we suggested that in the structure and functions of our institutions are features, perhaps desirable or even necessary, which limit communication, interaction and hence comprehension in management.

Improvement in these matters will, like the present circumstances, evolve rather than be created. Therefore, and because many minds are bearing on the problem of coastal zone management, it should be instructive to examine a situation in Eastern Canada for evidence of trends in policy and practise that embody our concerns. The example is not typical of Canada and perhaps elsewhere but it contains the essential elements of the problem.

THE MARITIMES; A DEVELOPING REGIONAL APPROACH

The Maritime Provinces (Nova Scotia, New Brunswick and Prince Edward Island), like most of the Atlantic region approximate a uniform geography and resources distribution; and with Newfoundland and Southeastern Quebec they form at the larger scale a discrete coastal zone system. This provides a basis for technical management and a rationale for its systematic and regional application.

Initially the Maritimes experienced rapid development, particularly in its coastal zone, but expectations were steadily foreclosed largely through the continuing and controlling development of the Great Lakes' basin. Its fortunes have lately improved through development, federal aid programs and its re-discovery by an affluent hinterland society in search of recreational activities.

The basis for this latter was abundant open space, low cost land and high environmental quality. It was a case of region so far behind in material advantages suddenly becoming far ahead in those intangible qualities lost elsewhere through overdevelopment; and the greatest of these was a comparatively unspoiled coastal zone and the fascination of the water's edge.

The rapid growth of the recreation industry is focussing attention on the coastal zone and, through conflicts with traditional pursuits, emphasizing the problems of other coastal resources. Especially vexing are questions of non-resident ownership, speculation in land and urbanization. Of much general concern is how to improve troubled agriculture and fisheries, guide urban and industrial growth and provide the infrastructure of transport, communications and energy.

Institutional changes in response to such a transition and the issues it raises have included revised statutes and policies, reorganized departments and attempts at improving planning through greater use of inter-agency committees. Four innovations of the past decade or so are potentially significant as regards communication, interpreting information

and comprehension in management:

1. The creation of the federal Department of Regional Economic Expansion (DREE).
2. The formation of the federal Department of Environment (DOE). This is an amalgam of functions in fisheries, inland and marine waters, forestry, land and wildlife; with new responsibilities for environmental research and protection.
3. The establishment of the Canadian Council of Resource and Environment Ministers (CCREM).
4. The formation of the Council of Maritime Premiers.

The Department of Regional Economic Expansion

This generously funded department exerts considerable influence by assisting individual industries and areal economic rationalization. Its emphasis on industry, trade and commerce lends a connotation of industrial exploitation to its work (one-half the aforementioned dichotomy of coastal zone interests) but increasingly DREE planning comprises environmental concerns, if only to the extent that these are recognized by participating agencies.

The point to be made, however, is that the full potential of DREE has yet to be realized in the coastal zone. By taking greater account of natural resources interaction and, thereby, of their productivity, the derived industries financially assisted by DREE can be better assured longer term viability. This should not be a charge upon DREE but rather a call for greater interaction among the related departments.

The Department of Environment

The advent of this department reflects growing public

recognition of the importance of natural systems. Its policy orientation to environmental management is, and should be, more tacit than explicit because most such management (i.e. of natural resources) rests with the provinces. In order to surmount this constitutional boundary, where cogent reasons pertain, accords have been reached with many provinces that facilitate joint policy and programming.

Like all environmental agencies DOE plays a co-ordinating, regulatory and supra-departmental role relative to most other departments; and it will require time in which to educate those and the public to the environmental ethic. A major instrument for this is the recent Canada Water Act, which collates and better rationalizes the once fractionated water legislation and facilitates more responsive policies, research and programs in water management. The importance of DOE, however, lies in its concern for resources conservation and protection of natural processes, the second half of the dichotomy of coastal zone interests.

At this point, recall our concern for the effect of exploitation and mis-directed technology on the stability of natural systems and the necessity of basing management decisions as much on ecological as other imperatives. Implicit in the mandates of DREE and DOE is the potential for accomplishing more intelligent management of resources. *In a closer union of their planning lies a systematic blend of environmental science and consciously directed technology.* Obviously, this also holds for provincial fields of environment and economic development.

The Canadian Council of Resource and Environment Ministers

This council provides a forum for informal discussion of matters of concern to environment ministers, that can be augmented by inviting the participation of ministers of issue related resources. It is unique among federal/provincial assemblies in that all governments have equal voice.

Through its operative committee of senior bureaucrats the council can probe into matters of concern through informative projects, a recent example being a study of land use issues in Canada. Although it cannot take decisions directly influencing governments it is clear that, through broader perspectives and understanding acquired, the ministers are better prepared for formal decisions. The importance and potential of Council are its educative and informative functions and role in stimulating interaction and co-operation.

The Council of Maritime Premiers

This organization, a little suspect as a fourth level of government, has made advances in comprehensive planning, the production of information and uniformity among regional regulations. Importantly, it is beginning to influence provincial policy and programming by recognizing the regional, if not systematic nature of economic and resource sectors.

Operating under Council are committees of provincial ministers (e.g. the Committee of Environment Ministers) through which some co-operative programs have been arranged (particularly for environmental protection), or

provincial programs enhanced by exchange of views. The coastal zone as a system for management is not yet acknowledged by Council but such matters as non-resident ownership and beach protection are being jointly considered. It seems clear, though, that Council's greatest attribute is its potential for overcoming parochial attitudes towards such politically transcendent matters as regional communications, transport and energy supply.

To conclude discussion of changing institutional arrangements we note what could be by far the greatest determinant of coastal zone and general resources management. It is *the rapidly changing perception by provinces of their role in influencing federal government policy. Their view acknowledges the need for a strong central management of the national well-being yet asserts a compelling argument for preserving the variety that is the nation and managing it through greater involvement of the user.*

This viewpoint reflects a maturing attitude towards confederation; reflects lessons learned from the successes and, more importantly, failures of massive federal aid programs; and it reflects renewed self confidence among provinces in managing their affairs.

This latter stems from the essentially different perspectives of the two levels of government. The federal, relating to the public and resources more in the abstract sense, tends to obscure the variety and detail of the managed sector. In contrast, the provincial governments are intimately associated with the citizen managers of resources and with the generation of wealth therefrom -- wealth that accrues in large measure to the common good, in turn managed by federal institutions.

Both mandates are necessary but, in their being exercised, the one should not intrude unnecessarily upon the other.

Accordingly, the provinces are saying in effect, *'within the context of national goals, aid us with funds and expertise and we can improve resources management and thereby the common good'.*

PRINCE EDWARD ISLAND; COASTAL ZONE IN MINIATURE

Prince Edward Island is an anomaly among the provinces of Canada. Tiny (2,000 square miles), pastoral and somewhat disadvantaged, by material standards, its status as a province emphasizes as do few other features the variety of Canada. With a maximum width under 40 miles the entire province is a coastal zone in some broader meaning of the term; its generalized shoreline of some 300 miles strongly indented to yield 1,000 miles around bays and estuaries. Its gently rolling landmass bears a patchwork half wooded, half cultivated -- the handiwork of a population half urban, half rural. A charming and special kind of place.

In 1969, the province and federal government established a 15-year program for rationalizing better the bases to the Island's economy, a comprehensive program of adjustment and development in virtually all its social and physical resources. This was planned by resource sectors with consideration for their interaction as an economic system but not, to any significant extent, as a natural system.

Work under the plan, especially applied research, was to be mission oriented rather than systematic. There were few requirements that limits to coastal resources management (or of other resource systems) be ascertained in terms of their supporting natural processes. The omission is understandable in view of how imperceptibly our awareness of complexity and resource

interaction was then growing, compared with the revelations of today.

Accordingly, it became recognized that the fuller potential of inshore fisheries, aquaculture, marshlands, coastal industry and recreation could not be achieved without better understanding their environmental factors and ecology. Also, without that knowledge the now discernible problems of coastal waters quality, as influenced by land use, cannot be treated satisfactorily.

In 1972-74, therefore, the federal and provincial departments of environment proposed a four-year program aimed at obtaining essential information, examining resources interaction and, through iterative modelling, estimating limits to coastal resources use.

The program was to have integrated with the above-mentioned development plan (itself largely funded by DREE) and to have involved water and land resource branches of DOE. Importantly though, most work would have been done by staffs of provincial departments, with feed-back information from research used to adjust management methods and objectives as the program progressed.

Recall now the promise inherent in a closer co-operation of DREE and DOE and the provincial aspiration of its applying federal assistance more directly to resources management.

The proposed coastal zone program was principally approved but set aside because of an uncertain fiscal climate. However, from the experience gained, certain points were identified which could bear on the success of future coastal zone planning.

The Task Force concerned with the Prince Edward Island coastal zone study realized that a major difficulty in preparing comprehensive plans is determining such a mix of authority, institutions and decision making as will best ensure successful implementation. Also, they received three lasting impressions from their work:

1. The complexity and systematic nature of the coastal zone and its problems.
2. The extent to which coastal resources administration, research and management are fractionated.
3. The complicated and relatively inflexible nature of institutional arrangements available for co-ordinated research and management.

Moreover, they recognized that, while the Prince Edward Island coastal zone is an entity, or system, in many respects, there are important bio-physical linkages with the Gulf of St. Lawrence ecosystem and socio-economic relationships with the Maritimes, Newfoundland and Southeastern Quebec which must be taken into account. This regional perspective influenced much of their thinking and prompted such notions as the establishment of a regional coastal zone authority as an aid to communication, co-ordination and decision making generally.

It seemed obvious that to attempt all management of individual coastal zones in isolation would exacerbate the already fractionated character of their research, development and management; and therefore the establishment of a regional coastal zone authority should be seriously considered. Such an institution would serve as a clearing house for information, a broker to help determine priorities and as a delegated authority for co-ordination. It should have statutory authority from both levels of government and be under

the immediate aegis of some variant of the Council of Maritime Premiers.

CONCLUSION

We have stressed the interdependence among coastal zone resources and the necessity of managing them as a system. We emphasized that their economic utilization should match the system's capability for sustainable production and that natural processes must be protected to the highest degree possible. The opinion was given that, in order to accomplish more intelligent management, we must improve our means of conceptualizing systematic processes and find better institutional arrangements for productive interaction among decision makers.

When reduced to its essentials man's treatment of his environment is still more influenced by emotion than reason; and we shall rise to the challenge of resources management only to the extent as does our level of ecological literacy and our acceptance of its message -- interdependence. We must learn the survival value of altruism and abandon the ages-old concept of 'man at the centre of all things'; or if not abandon, then recognize that such a position makes us stewards, not masters, of the environment that sustains us. *With that new ethic for survival we can then proceed to rationalize the needs and aspirations of a conserver society, through some alternative technology, to a state of environmental and social harmony.*

Appendix I

Some pertinent literature

Anon. 1970. *Canada, Science and the Oceans.* Science Council of Canada, Report No. 10; Information Canada, Ottawa.

Anon. 1972. *Ecological effects of human activities on the value and resources of lakes, marshes, rivers, deltas, estuaries and coastal zones.* UNESCO Program on Man and the Biosphere, Final report No. 5.

Anon. 1973. *Essays on Aspects of Resource Policy.* Background Study (No. 27) for the Science Council of Canada; Information Canada, Ottawa.

Anon. 1974. *The Allocative Conflicts in Water Resource Management.* The Agassiz Centre for Water Studies; The University of Manitoba, Winnipeg, Manitoba.

Anon. 1976. *Coastal Ecosystems; Research Framework.* Man and the Biosphere Program (Canada), Report No.7; The Canadian Committee for MAB, Environment Canada, Ottawa.

Armstrong, John H., *et al.* 1974. *Coastal Zone Management: The Process of Program Development.* Coastal Zone Management Institute, P.O.Box 221, Sandwich, Massachusetts.

Beer, Stafford. 1975. *Platform for Change.* John Wiley Limited, London and New York.

Erhlich, Paul R., and Anne H. Erhlich. 1972. *Population, Resources, Environment; Issues in Human Ecology*, 2nd Edit. W.H.Freeman and Company, San Francisco.

Jackson, R.W. 1976. *Human Goals and Science Policy.* Science Council of Canada, Background Study No. 38; Printing and Publishing, Supply and Services Canada, Ottawa.

Johnston, D.M., A.Paul Pross and Ian MacDougal. 1975. *Coastal Zone: Framework for Management in Atlantic Canada.* Institute of Public Affairs, Dalhousie University, Halifax, Nova Scotia.

Ketchum, Bostwick. (Edit.) 1972. *The Water's Edge: Critical Problems of the Coastal Zone.* The MIT Press, Cambridge, Massachusetts.

Stewart, R.W., and L.M.Dickie. 1971. *Ad Mare: Canada Looks to the Sea.* Background Study (No.16) for the Science Council of Canada; Information Canada, Ottawa.

Strong, Maurice F. 1973. *The Environment and the New Internationalism.* 1973 Fairfield Osborn memorial lecture; The Conservation Foundation, 1717 Massachusetts Avenue N.W., Washington D.C.

Swainson, Neil A. (Edit.) 1976. *Managing the Water Environment.* University of British Columbia Press, Vancouver, British Columbia.

Ward, Barbara. 1976. *The Home of Man.* McClelland and Stewart Limited, 25 Hollinger Road, Toronto, Ontario.